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PERFORMANCE EVALUATION OF RIP AND OSPF IN IPV6 USING OPNET 14.5 SIMULATOR

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Abstract— In this modern internet era, routing protocol plays an important role. They forward the packets form source to destination. There are many routing protocols are used. In this paper, we evaluated the performance of different routing protocol like RIP and OSPF for IPv6. OPNET simulation tool 14.5 is used to evaluate the performance of RIP and OSPF in three network models in which two network models will perform on one routing protocol only while the third are used to evaluate the performance of these routing protocol are packet delay variation, end to end delay, traffic received, traffic sent, response time, jitter, page response time, object response time, traffic dropped for IPv6 Etc. we designed three scenarios to compare their performance.

Keywords: RIP, OSPF, OPNET14.5, Performance analysis, IPv6.

I. INTRODUCTION

Routing refers to the process of determining the best route for the transmission of data packets from source to destination and it is based upon routing protocols. Routing protocols are a set of rules in which communication network follows when computers try to communicate with each other across networks and communication between two routing protocols is dependent upon the routing algorithm which is purely dependent upon the metrics to find the path to transfer the data across two networks [1]. Routing protocols utilize a routing table to store the results of these metrics. There are two types of routing protocols: interior gateway protocol (IGP) and exterior gateway protocol (EGP). RIP, OSPF, EIGRP are most commonly used IGPs and a typical EGP is BGP (Border Gateway Protocol) [2]. Now a day's many routing protocol exist, among these routing protocol most famous are RIP (Routing Information Protocol) and OSPF (Open Shortest Path First). Both are the examples of interior gateway routing protocol. RIP is a distance vector dynamic routing protocol that uses hop count as its routing metrics. OSPF is a link state routing protocol that uses cost and bandwidth as its routing metrics. In this type of routing protocol, each router works independently to calculate its own shorter route towards the destination [1].IPv6 (internet protocol version6) is a new addressing protocol developed in 1999 designed to remove the shortcoming of IPv4. IPv4 (internet protocol version 4) was developed in 1981; did not get any major change afterward and also it provides only 32 bit addressing space containing 4.3 billion unique internet protocol addresses. Each internet enabled device requires a unique IP address from this address space. But the rapid growth of the internet has resulted in these addresses being exhausted. IPv6 has 128 bits address space which is four times more than IPv4. Moreover, IPv6 brings a number of improvements over IPv4 to increase addressing space. IPv4 must have IPSec security, making it more secure than IPv4 [3]. In this paper, we analysis the performance of RIP and OSPF routing protocol on IPv6 and also compared and analyzed simulation results in terms of Database Query response time, page response time and object response time in HTTP, IPv6 Traffic dropped, jitter, end to end delay, traffic received and traffic sent in Voice, packet delay variation, end to end delay, traffic received and traffic sent in Video Conferencing.

II. RELATED WORK

Loan Fitigau and Gavril Toderean [4], network performance evaluation for RIP, OSPF and EIGRP routing protocols in OPNET simulator and using various simulation scenarios to compare their performance. Mohamad A. Yehia,Mohammed S. Aziz,Hussein A. Elsayed [5], presents a comparative analysis of routing protocol EIGRP,OSPF and RIP for real time applications. Don Xu and Ljilijana Trajkovic [2], comparing the performance of routing protocol such as RIP, EIGRP and OSPF using OPNET modeler using various parameters like network convergence, Ethernet delay, email upload response time etc. Sajad Farhangi and Saeed Golmohammadi [6], describes the evaluation of IS-IS and IGRP on performance parameters such as convergence duration, throughout, packet delay variation, packet end to end delay and traffic sent. Alex Hinds, Anthony Atojoko and Shao Yin`g Zhu [3], studied the routing protocols OSPF and EIGRP showing the differences between IPv4 and IPv6. IKram Ud Din and Saeed Mahfooz [7], performance analysis of routing protocols RIP, OSPF, IGRP and EIGRP for the parameters such as packets dropping, traffic received, end to end delay and jitter in voice. V.Vetriselvan, Pravin R. Patil and M.Mahendran [8], survey the performance evaluation of various routing protocol such as RIP, OSPF and EIGRP with certain criteria such as jitter, convergence time, end –to-end delay., throughput, queuing delay, link utilization. Saubhagya Das, Santosh Subedi and N. Shekar V. Shet [9], network performance analysis of dynamic routing protocols for real time applications such as Delay, FTP, E-mail, HTTP, VoIP and Video Conferencing through the simulated network models.

III. PROTOCOL CONCEPTS

A. RIP (Routing Information Protocol)

RIP is a distance vector dynamic routing protocol that uses the hop count as its routing metrics. RIP prevents routing loops by implementing a limit on the number of hops allowed in a path from source to destination. The maximum number of hops allowed for RIP is 15. This hop limit also limits the size of networks that RIP can support. A hop count of 16 is considered an infinite distance, in other words the route is considered unreachable. RIP implements the split horizon, route poisoning and hold down mechanisms to prevent incorrect routing information from being propagated [10]. RIP only maintains the routing table of the best path in the network for every destination. There are three versions of Routing Information Protocol: RIPv1, RIPv2and RIPNG.

RIPv1 is a Classful routing protocol but RIPv2 is a Classless routing protocol. RIPNG is an extension of RIPv2 and also supports IPv6 networking.

B. OSPF (Open Shortest Path First)

OSPF was designed with the specific goal of handling routing tasks within an enterprise network; this requires quick convergence, minimum routing traffic, and better security. OSPF is a link state protocol and also maintains the routing table for all connections in the network. The concept of OSPF routing is based on creating, maintaining and distributing a link –state database, which describes a collection of routers and their operational interfaces, how they are interconnected and cost to use the interfaces. Cost is a metrics used to describe the relative efficiency of various routes to the destination. Each router in the routing domain is responsible for the creation of its local piece of topology by link state advertisements (LSA). LSAs contain information describing routers, networks, reachable routes, route prefixes and metrics. The LSAs are then reliably distributed to all other routers in a process called flooding, which allows OSPF routers to synchronize their topology databases. Most of the OSPF operations are dedicated to keeping the link-state database synchronized among OSPF routers. As long as every OSPF router has an identical link state database, every router can calculate the shortest paths to the advertised destination, using Dijkstra Shortest Path First algorithm [11].

IV. SIMULATION NETWORK TOPOLOGY

In this paper, we used OPNET 14.5 Simulator. OPNET is a high level simulation tool that has been used in many high level researches. It enables simulation of heterogonous networks by employing a various protocols [12]. In real, we cannot create such a network; it is possible only simulation because simulation provides us mathematical and graphical form of result and we can easily understand these results. In the network, we have 11 routers that are Cisco 7000 series and all the routers are connected together with point to point (PPP) using Digital Signal 3 (DS3) link model and also we have used four LANs that is Ethernet LANs and four workstations that is Cisco WS-C3560 series and four Ethernet Server .All the workstations are connected with one router, one LAN and one server with 100BaseT link models. LAN is used to configure different application such as HTTP, database query, voice conferencing and voice. LAN1 is for video conferencing, LAN2 is for voice, LAN3 is for database query and LAN4 is for HTTP. We have one application definition and profile definition. The profile definition is used to create users profiles to be specified in different nodes in the network [5]. We have four profiles that are HTTP, voice, video conferencing and database query. All the profiles are configured with operation mode set to simultaneous and number of repetitions is constant (0). We are used to application definition to define parameters for video conferencing application such as Frame Interarrival time =15 frames/sec, Frame Size Information (bytes) =128*240 pixel, Type of Services=best effort (0), Symbolic Destination Name=video destination.For voice application such as encoder scheme is G.729 A (silence), Type of Service (TOS) is best effort (0), voice frames per packet is 1and compression and decompression delay is 0.02 second. For HTTP such as Page Interarrival time =exponential (10) in seconds. In page properties, we have two rows -object size first is constant (1000) and second is medium image and number of objects (objects per page) is constant (1) and constant (2). And in server selection, initial repeat probability is search and page per server is exponential (2). For database query, Transaction Interarrival time (seconds) =exponential (12), Transaction Size (bytes) =constant(32768) and Type of Service= best effort(0).

Table 1: Applications Description

Voice	IT Telephony and Silence Suppressed
Voice Conferencing	High Resolution
HTTP	Searching
Database Query	High Load

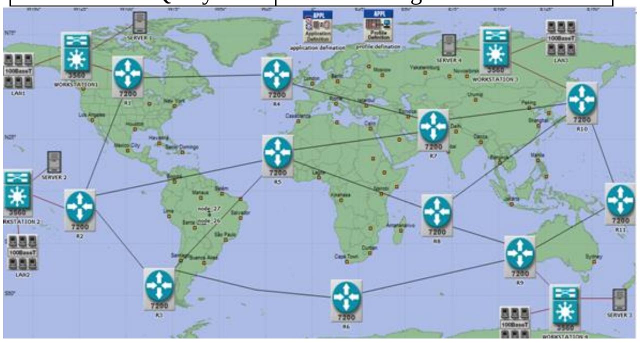

Fig 1: Network Model

V. SIMUATION RESULTS

Our simulation involves three scenarios for the network topology. The simulation time is set to 600 seconds for RIPNG, OSPFv3 and OSPFv3_RIPng scenarios.

A. Packet delay variation:

This parameter is defined as a delay in receiving packets at the receiver. On the transmitter side, data packets are sent continuously in the channel. Due to networks congestion, improper queuing, or configuration errors, the packet may not receive, in the order that the transmitter and receiver with the same period were sent. In real-time applications such as video conferencing packets delay cannot be ignored due to the Packet delay variation, which causes packet loss and also there will be no recovery of video. Packet delay variation for voice conferencing traffic is ilustracted in figure 3. According to the figure, OSPFv3_RIPNG has lower value than other scenarios and so OSPFv3_RIPNG shows better performance.

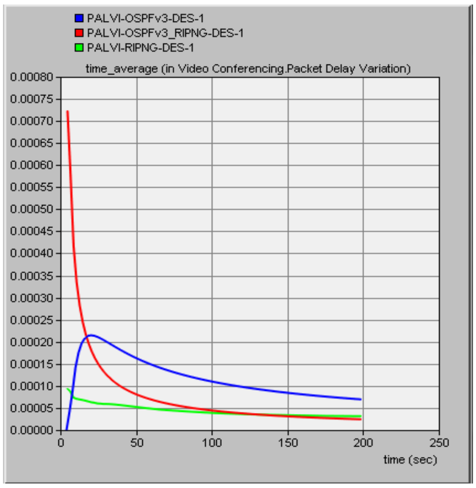

Fig 2: Video Conferencing Packet Delay Variation

B. End to End Delay

When the packets transmitted by a network from source to destination then end to end delay time has been considered. When it takes too much time to arrive the packets to the receiver, it causing delays in the whole process and therefore has a critical effect on the performance of a communication network. Network with large values of end to end delay, the packet can be efficiently destroyed. Packet losses due to large end to end delay will have impact on the quality of both audio and video traffic on the receiver. The end to end delay for video conferencing in figure 3, OSPFv3 has minimum end to end delay compared with other scenarios. So OSPFv3 performs well.

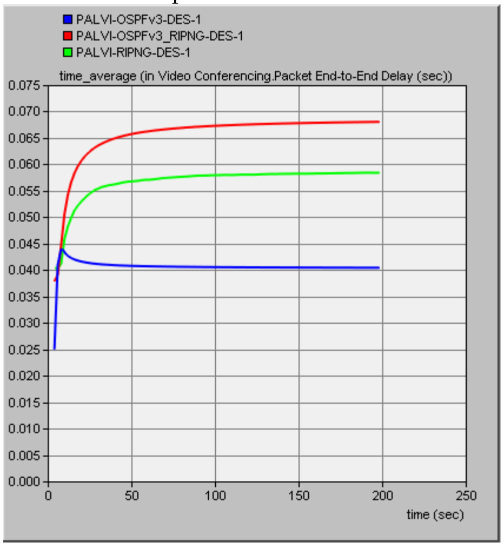

Fig 3: Packet End To End Delay In Video Conferencing

In voice, OSPFv3_RIPNG has minimum end to end delay compared with other scenarios.

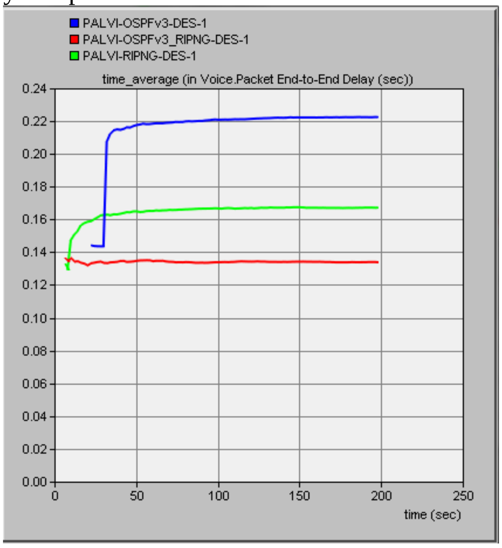

Fig 4: Packet End To End Delay In Voice

C. Traffic Received

Voice/Video traffic is the total number of audio and video packets received during video conferencing or other type of real time communication. In video conferencing, OSPFv3 receives less traffic than other scenarios.

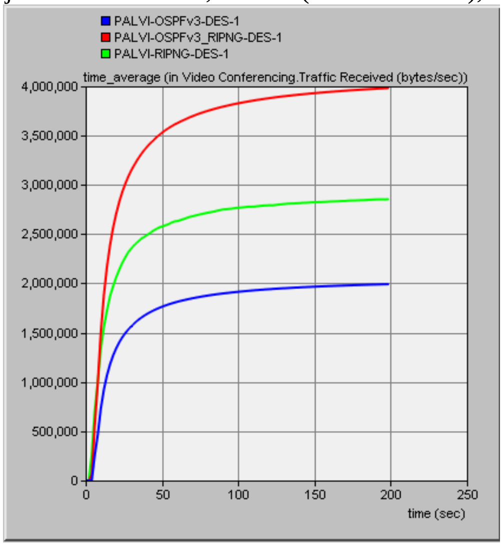

Fig 5: Traffic received in video conferencing

In voice, OSPFv3_RIPNG receives less traffic than OSPFv3 and RIPNG. So OSPFv3_RIPNG performance is better than other scenarios.

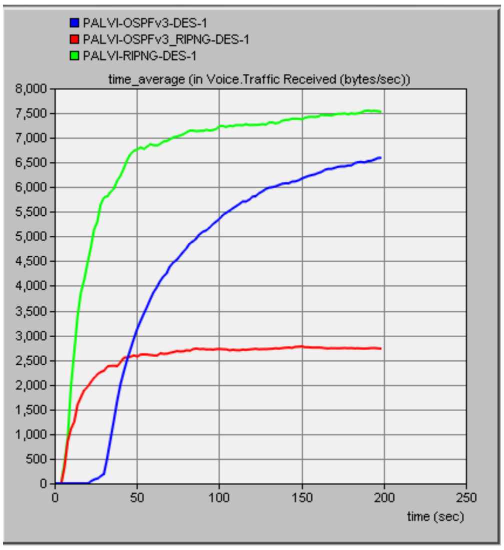

Fig 6: Traffic Received in Voice

D. Traffic Sent

Voice/ Video traffic is the total number of audio and video packets sent during video conferencing or other type of real time communication. In fig 7, OSPFv3 sends less traffic and OSPFv3_RIPNG send more traffic. So the performance of OSPFv3 is better than other scenarios.

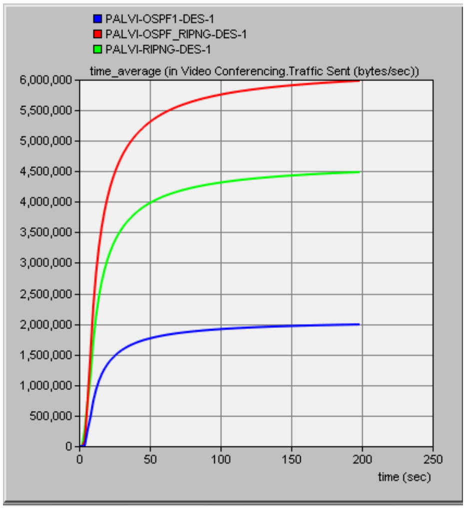

Fig 7: Traffic Sent in Video Conferencing

In voice fig 8, OSPFv3_RIPNG sends less traffic and RIPNG has more. So OSPFv3_RIPNG performance is better than other scenarios.

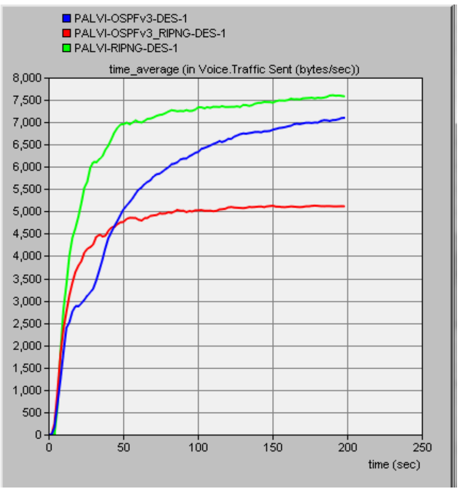

Fig 8: Traffic Sent in Voice

E. Jitter in voice

Jitter is defined as variation in delay times of received packets. At sending sides, packets are sent in a continuous stream in a equally spaced time slots. The rate is much lower than average rate, resulting from traffic congestion and for improving performance of a voice network this factor should be as small as possible. In fig. 9, combination of OSPFv3_RIPNG has the lowest jitter than OSPFv3 and RIPNG.

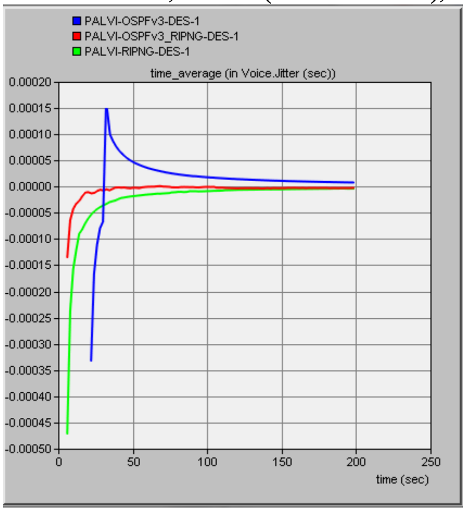

Fig 9: Jitter in Voice

F. Traffic dropped in IPv6

When a router or switch is unable to receive incoming data packets at a given time, is called packet loss/ drop. In fig 10, RIPNG has the least number of packets dropped as compared to another scenario. So RIPNG performance is better.

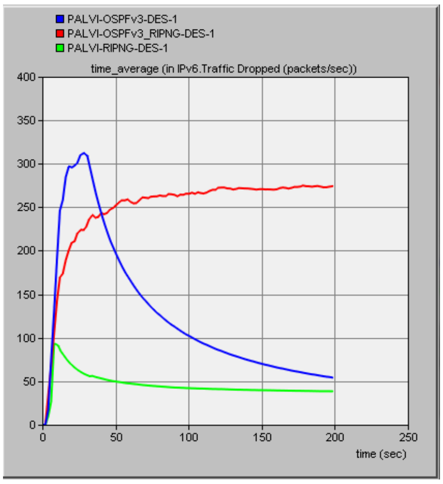

Fig 10: Traffic Dropped in IPv6

G. Page response time in HTTP

OSPFv3_RIPNG takes less time than RIPNG and OSPFv3. So OSPFv3_RIPNG performs well.

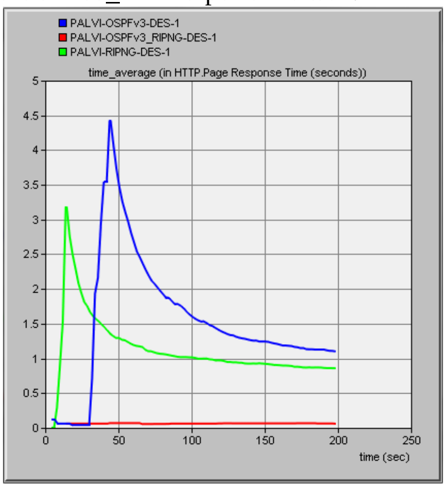

Fig 11: Page Response time in HTTP

H. Object response Time in HTTP

In object response time, the OSPFv3_RIPNG takes less time than RIPNG and OSPFv3. So OSPFv3_RIPNG performance is better than others scenarios.

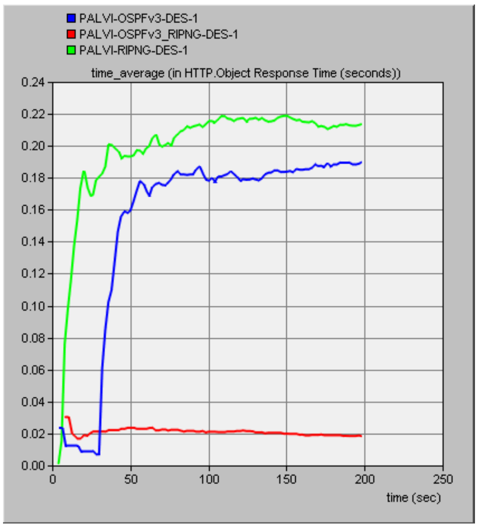

Fig 12: Object Response Time in HTTP

I. Response time in Database Query

Time elapsed between sending a request and receiving the response packet for the database query application in this node. Measured from the time a client application sends a request to the server to the time it receives a response packet. In fig 13, the response time of OSPFv3 is better than other scenarios.

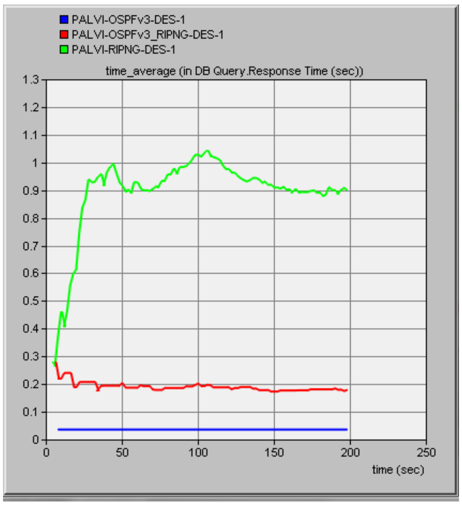

Fig 13: Response Time in Database Query

VI. CONCLUSION

RIP and OSPF are Interior Gateway Routing Protocols widely used in computer networking. In this paper, we have presented a comparative analysis of selected routing protocols such as RIP and OSPF in IPv6. The comparative analysis has been done in the same network with different protocols for real time applications. Performance has been measured on the basis of the parameters that aimed to figure out the effect of routing protocols.

In the implementation, Packet Delay Variation in Video Conferencing, Jitter, End to End Delay, Traffic Received, and Traffic Sent in voice and Object Response Time and Page response Time in HTTP performs better in OSPFv3_RIPNG (combination of RIPNG and OSPFv3) than RIPNG and OSPFv3.

Another Performance Metrics for real time applications is End to End Delay, Traffic Received and Traffic sent in Video Conferencing, Response time in Database Query performs better in OSPFv3 than OSPFv3_RIPNG and RIPNG.
Traffic Dropped in IPv6 parameter performs better in RIPNG than OSPFv3 and OSPFv3_RIPNG in IPv6.

In this work, the comparative performance among RIP, OSPF and combination of RIP and OSPF routing protocols in IPv6 for real time applications has been analyzed. By comparing these protocols performance, we have come across that the combined implementation of RIPNG and OSPFv3 routing protocol in the network in IPv6 performs better than RIPNG and OSPFv3. In the case of individual routing protocol performance, overall performance of OSPFv3 is better than RIPNG.

REFERENCES

[1] Jagdeep Singh and Dr. Rajiv Mahajan,"Simulation Based Comparative Study Of RIP, OSPF and EIGRP", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 8, August 2013.
[2] Don Xu and Ljiljana Trajkovic, "Performance Analysis of RIP, EIGRP and OSPF using OPNET", vancouver, British Columbia, Canada.
[3] Alex Hinds, Anthony Atojoko and Shao Ying Zhu, "Evaluation of OSPF and EIGRP Routing Prorocol for IPV6 ", International Journal of Future Computer and Communication, Vol.2, 4 August 2013.
[4] Loan fitigau and Gavril Toderean, "Network Performance Evaluation for RIP, OSPF and EIGRP Routing Protocols", IEEE 2013.
[5] Mohamad A. Yehja, Mohammed S. Aziz, Hussein A. Elsayed," Analysis of IGP Routing Protocols for Real Time Applications: A Comparative Study ", International Journal of Computer Application (0975-8887), Volume 26-No. 3, July 2011.
[6] Sajad Farhangi and Saeed Golmohammadi, “A comparative study of IS-IS and IGRP protocols for Real time applications based on OPNET”, Advances in Electrical Engineering Systems, Vol. 1, No. 1, March 2012, pages 65-70.
[7] IKram Ud Din, Saeed Mahfooz and Muhammad Adnan, “Analysis of the routing protocols in the Real Time Transmission: A Comparative study”, Global Journal of Computer Science and Technology, Vol. 10, Issue 5, Ver. 1.0, July 2010, pages 18-22.
[8] V.Vetriselvan, Pravin R. Patil, M.Mahendran,"Survey on the RIP, OSPF, EIGRP Routing Protocol",(IJCSIT) international journal of computer science and information technologies,Vol. 5(2),2014,1058-1065.
[9] Saubhagya Das, Santosh Subedi and N. Shekar V. Shet, “ Network Performance Anaysis of Dynamic Routing protocols real time applications”, International Journal of Modern Engineering Research,Vol.4, Issue 5, May 2014, pp. 49-57.
[10] http://www.cisco.com/c/en/ US/ td/docs/ios/
[11] www.ixiacom.com/pdfs/library/white_papers/ospf.pdf
[12] Shah. A and Waqas J. Rana, "Performance Analysis of RIP and OSPF in Network Using OPNET", IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 6, No.2, Novermber 2013.